Session 157: Beyond Nutrients? Potential role of ultra-processed foods in obesity

Disclosures for Dr. Hall and Dr. Courville

- Required: Employer
  - National Institutes of Health
- Board Member/Advisory Panel
  - None
- Consultant
  - None
- Employee
  - National Institutes of Health
- Research Support
  - Intramural Research Program of the National Institutes of Health
- Speaker’s Bureau
  - None
- Stock/Shareholder
  - None

Learning Outcomes

At the end of this session, the participant will be able to:
- describe the concept of an ultra-processed food
- understand the NOVA food classification system
- describe the potential role of ultra-processed foods in obesity
- describe the process of creating and providing highly controlled metabolic diets that differ in processing

Diet Quality & “Nutritionism”

Nutritionism – or nutritional reductionism – is characterized by a reductive focus on the nutrient composition of foods as the means for understanding their healthfulness, as well as by a reductive interpretation of the role of these nutrients in bodily health.
In the case of nutritionism, the widely shared but unexamined assumption is that the key to understanding food is indeed the nutrient. Put another way: Foods are essentially the sum of their nutrient parts.
Ultra-processed vs Unprocessed Diet Study

The meals had similar amounts of:
- Calories
- Carbs
- Fat
- Protein
- Sugar
- Sodium
- Fiber

20 Adults were instructed to eat as much or as little as desired.

Primary Outcome: Energy Intake Differences

Ultra-processed Diets Cause Increased Intake

More Carbs & Fat with Ultra-processed Diets

Larger Meals with Ultra-processed Diets

No Differences in Self-Reported Appetite
No Differences in Pleasantness or Familiarity

Faster Eating Rate for Ultra-processed Meals

Ultra-processed Diets Cause Weight Gain

Ultra-processed Diets Cause Fat Gain
**Weight & Fat Gain with Ultra-processed Diets**

![Graph showing mass change (kg) vs. dietary intake](image)

**Substantial Individual Variability**

![Graph showing body weight change vs. energy intake](image)

**Key Questions:**

- What are the mechanisms by which ultra-processed versus unprocessed diets influence calorie intake?
  - Not Salt, Sugar, Fat, or Fiber?
  - Not Palatability?
  - Energy Density of Non-Beverage Foods?
  - Oro-sensory properties & Eating Rate?
  - Hormones? PYY? Ghrelin?
  - Protein Leverage? X Leverage?
  - Artificial Flavors, other ingredients, or lack thereof?
  - Role of the Microbiome?
**Key Questions:**

- Can ultra-processed foods be reformulated to avoid their effects on calorie intake and weight gain?
  - Perhaps, but we first need to better understand mechanisms
  - Our study suggests that a focus on Salt, Sugar, & Fat may not necessarily be effective
- Is it a feature or a flaw of NOVA that product reformulation can’t move an ultra-processed product into another NOVA category?
  - Can’t turn a “bad food” into a “good food” by changing its nutrient profile

**Key Questions:**

- Policy implications are not necessarily clear
  - Ultra-processed foods are convenient, tasty, inexpensive, and safe from a microbiological perspective
  - Ultra-processed foods contribute a large fraction of habitual dietary calories and nutrients in the USA and elsewhere
  - Preparing meals from unprocessed foods and culinary ingredients takes more time, money, skill, and equipment to do safely and effectively
  - A tax on ultra-processed foods would likely be regressive and disproportionately affect those in lower SES
NOVA Classification System

- Classifies foods into 4 groups
  - Unprocessed or Minimally Processed
  - Processed Culinary Ingredients
  - Processed Foods
  - Ultra-Processed Foods

NOVA Classification System

- Unprocessed or Minimally Processed Foods
  - Fresh, dry or frozen fruits or vegetables
  - Grains
  - Legumes
  - Meat
  - Fish
  - Milk

- Processed Culinary Ingredients
  - Table sugar
  - Oils
  - Fats
  - Salt
  - Other substances extracted from foods or from nature, and used in kitchens to make culinary preparations
**NOVA Classification System**

- *Processed foods*
  - Foods manufactured with the addition of salt or sugar or other substances of culinary use to unprocessed or minimally processed foods, such as canned food and simple breads and cheese.

- *Ultra-processed Foods*
  - Formulations of several ingredients which, besides salt, sugar, oils and fats, include food substances not used in culinary preparations, in particular, flavors, colors, sweeteners, emulsifiers and other additives used to imitate sensorial qualities of unprocessed or minimally processed foods and their culinary preparations or to disguise undesirable qualities of the final product.

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**CREATING THE DIETS**

- 7-day rotating menu
- 2 weeks on each diet
- Base menus 150% of energy needs
- Snacks 50% of total energy needs
Energy and nutrients

- **Energy**
  - Twice the basal metabolic rate with activity factor of 1.6
- **Nutrients controlled**
  - Carbohydrate (50±5%)
  - Fat (35±5%)
  - Protein (15±5%)
  - Sodium – matched
  - Total Sugar - matched
  - Total Fiber - matched

Food sourcing

- Available with main supplier
- Had food codes that were available in USDA and FNDDS databases or NDSR

<table>
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<th>Food Code</th>
<th>Amount (g)</th>
<th>Energy (kcal)</th>
<th>Fat (g)</th>
<th>Carbohydrate (g)</th>
<th>Protein (g)</th>
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<td>5.4</td>
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Food labels

Diet Design

Calculated to gram weights in specialized nutrition software (ProNutra, Viocare, Inc)

Foods measured to the tenth of a gram by metabolic cooks
Testing

Base Diets

- Energy at 2000 kcal for the week
- Nutrients
  - Carbohydrate
  - Fat
  - Protein
- Sodium – matched
- Total Sugar – matched
- Total Fiber - matched

Base Diets

- Nutrients naturally higher in ultra-processed foods
- Nutrients naturally higher in unprocessed foods – Fiber

Additional Challenges

Photo by Jennifer Rymaruk/NIDDK
Snacks

• Unable to refrigerate snacks
  – Non-perishable
• Bins to hold food, water and waste
• Easily transportable
• Daily inventory

Participant Recruitment and Screening

• Recruitment office
• Research nurse calls patient for phone screening
  – Reviews any food allergies, intolerances or disliking of specific foods
• Patient comes in for “in person” screening visit
• Fills out nutrition questionnaires
  – DHQIII
  – Food liking questionnaire
• Test tray and menu of all foods for each two week rotation

Participant Recruitment and Screening

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Logistical Challenges and Nuances

- Menu creation:
  - Constraints on food supply/ingredients – try to limit the amount of items to those already purchased by the main hospital kitchen
  - Staffing
    - Cook weekend hours – cold dinners for quality
- Metabolic Chamber
  - menu must be kept same for both visits
  - ad libitum snacks
- Lack of refrigerators in patient rooms for snacks

Consistency between participants

Ultra-processed vs Unprocessed Diets

The meals had similar amounts of:
- Calories, Carbs, Fat, Protein, Sugar, Sodium, Fiber

20 Adults were instructed to eat as much or as little as desired

Primary Outcome: Energy Intake Differences


Reformulation of Diets for New Study

- Many comments from people who read the paper
  - Energy density of non-beverage foods
  - Small protein difference (<1%)
  - Visual appearance, palatability, eating rate
  - Ultra-processed diet was not similar enough to the unprocessed diet
  - Snacks very different
  - Fiber matched but very different types of fiber
  - Total fat matched but type different
Thanks to everyone that made this happen!

Metabolic Dietitians
Shanna Yang
Sara Turner
Merel Kozlosky

Metabolic Cooks
Waters
Joshua

Metabolic Health Technicians
Klaudia Raisinger
Carl Andrey
Kelly Pauly

Dr. Hall for all of his great ideas and support!
The Hall research team.
All the participants that make this happen.

Practice Applications
- A diet high in ultra-processed foods promotes increased calorie intake and weight gain
- The mechanisms responsible for why ultra-processed food leads to excess calorie intake are uncertain, but likely involves factors beyond nutrient composition
- More research is required to better understand the mechanisms whereby ultra-processed foods promote excess calorie intake and whether such foods can be reformulated to mitigate these effects